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PRESIDENT'S MESSAGE

The city of Seattle and the University of Washington have made continuing progress during the past few weeks in defining their respective roles in the future development and maintenance of the Arboretum.

With these decisions made, the time has come for the city to establish the leadership role which it has assumed under the revisions made in the City/University Agreement of 1934, under which the Arboretum is operated.

We call on both the city and the University to move forward in their joint program of arboretum development, and pledge our support of their efforts in continuing to improve this unique asset for the particular benefit of the citizens of this region.

In this regard, the Foundation is now developing its recommendations for priority development programs. We have been assured that our recommendations will be carefully considered and we look forward to being of substantial assistance in accomplishing the objectives which will flow from this review.

Sincerely,

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THE UNIVERSITY OF WASHINGTON
Arboretum bulletin

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Prunus x hillieri
(see p. 17)

Photo: Don Normark

Experiments conducted in the phytotron helped to clarify the peculiar flowering requirements of the African violet. Photo: *Plants Alive*.

Phytotrons

*FRITS W. WENT**

A phytotron is a relatively new tool for the botanist and the horticulturist. It is in principle nothing more than a very sophisticated greenhouse, being an assembly of plant growing rooms in which most climatic factors such as temperature, light, humidity and wind can be controlled accurately. Greenhouses have been in use for the last couple of hundred years and were developed in temperate climates to provide artificial growing conditions favorable to plants from tropical climates such as orchids or palms. In a botanical garden in the temperate regions, only plants which can tolerate the local climate can grow, and any frost-susceptible plant from warmer regions cannot survive. Thus, in Northern Europe and the Northern United States, Mediterranean plants such as oranges and figs, did not survive outside, but instead needed protection during winter. In more recent years, it was found that tropical plants such as the more spectacular orchids or bananas needed more than just a frost-free environment. They had to be kept in a warm environment all during winter, which required a generally heated greenhouse. Finally, we found that many plants could not grow at all when temperatures rose too high in the greenhouse, such as during summer in a continental climate. To grow such plants well, it was necessary not only to keep a greenhouse warm during winter, but also cool during summer. This required air-conditioning in the greenhouse and it was Dr. Larry Marshall and Dr. Henry Eversole who constructed the first fully air-conditioned greenhouses in the early 1930's. Their success in growing plants was so phenomenal that it became clear that such air-conditioned greenhouses might provide a solution to the many problems of plant growth. With the help of these pioneers, in the literal sense, a set of air-conditioned greenhouses was built at the California Institute of Technology, which in 1949 were expanded into the Earhart Plant Research Laboratory** and received the name Phytotron. In the six greenhouses of this first phytotron, the temperature could be maintained for weeks or years at a constant level. Thus at any time we could grow plants

*Dr. Went is Professor of Botany, Laboratory of Desert Biology, Desert Research Institute University of Nevada System, Reno, Nevada.

**The Earhart Plant Research Laboratory is no longer extant.

under either spring, summer, or tropical conditions. In a number of artificially lighted rooms, not only temperature, but also lighting was under control. In a third set of rooms, wind, rain, and gas content of the air could be manipulated. Thus, through the phytotron, the effect of each of these climatic variables could be investigated individually and in combination.

The first plant I investigated in this phytotron was the tomato. Horticulturists knew that fruit production of this plant was commercially possible only in warm climates, but it was difficult to understand why it grew so poorly in the hot summers of Florida and Texas. In the phytotron we found that tomato production in a greenhouse kept at 80°F was exceedingly poor. For a whole year I grew hundreds of tomato plants in this warm greenhouse and obtained only three or four ripe tomatoes. At that time nobody could explain to me why those plants behaved so miserably, by just growing vegetatively. But, when I started to move the tomato plants from one greenhouse to another I immediately obtained good production; whenever the plants were kept in a greenhouse at 65°F during nighttime, they immediately produced large quantities of fruit. It also was found that at either 55°F or 75°F fruit production was very much reduced, and in still cooler or warmer nights they failed to produce fruit at all. In these experiments I also found that the temperature conditions during the day had very little influence on tomato fruit production.

When looking up the temperatures existing in good and poor tomato-producing climates and results from work in the field, we found that the critical condition for tomatoes was nighttime temperature. In an oceanic climate where the days are cool and the nights remain approximately 65°F, tomato production was excellent. Another instance of good production was in the central valley of California where a night-temperature of 65°F is coupled with a daytime temperature in summer of nearly 100°F. But in the tropics, with night temperatures of 75°F and day temperatures of 90°F (with the same average temperature for a 24-hour day as in California), tomatoes hardly produce fruit.

The tomato is a good example of the type of problems which can be investigated in a phytotron, where so many different climatic factors can be controlled both individually and jointly. In working with other plants it was soon found that almost every plant has different requirements for the best, or optimal, growth. Let us take, as another example, the potato. In this case it is not the flowering and fruiting about which we want to know the optimal conditions, but rather the underground tuber formation. When potatoes were grown under different light- and temperature-conditions, it was found that tubers were formed only at night temperatures below 65°F. Even though the above-ground growth of potato plants was more abundant at higher temperatures, the potato plant grew spindly and vine-like at these high temperatures. In addition, tuber formation at the higher night-temperatures occurred only under short-day conditions, whereas a lower night temperature such as 45°F or 50°F produced numerous tubers even in continuous light.

This response of the potato plant to climate explains why our main potato-producing states are in the north of our country, such as Idaho and Maine, and why the potato is such an important crop plant in Ireland, with its cool summers. In no country where potatoes grow well can tomatoes be produced commercially and in tomato-producing states such as California, a potato crop can only be grown in spring or autumn.

Peas behave in an entirely different manner. They don't respond to the temperature of the night but during day have to be kept cool. Therefore peas are mainly grown as "escape crops." Since high summer temperatures ruin their productivity, they are mostly produced as a spring vegetable. Since the sweet pea behaves very much like peas they also cannot be grown during mid-summer in warmer climates.

Among the first plants investigated in the Pasadena phytotron, were garden flowers. Some of them, like the Iceland poppies and English daisies, required very cool temperatures and would not flower, or even survive, in the warmer greenhouses. That is the reason

why these plants are typical spring flowers in our gardens. In contrast to these low-temperature garden flowers are zinnias, and other summer flowers which grow best at high temperatures. The most extreme among them is the African violet, which cannot be grown out of doors in any area of the United States. It is exclusively a house plant. When I investigated this plant in the Earhart Laboratory, it only grew well with night temperatures of 70°F or even higher. This is the reason for its success as a house plant. By European standards, American homes are overheated, thus making an ideal growing environment for this plant. Houses in which the windows are kept open during the night are usually too cold for African violet growing. Because of this I can to some extent analyze the living habits of people, by knowing which plants they grow in their homes. It is the botanists' equivalent to the psychologists' dream analysis.

In my youth, now 50 years ago, most botanical gardens had some greenhouses and their plants were usually segregated according to their family. Thus there were orchid houses, fern houses, or a palm house, and often people wondered why one grower was more successful with one type of orchid such as Cattleya, whereas another grower had more luck with Phalaenopsis. The reason for this lies in the different optimal temperatures. A Cattleya's optimal night temperature is near 65°F, whereas the Phalaenopsis does much better at 80°F. In contrast, most lady-slippers (Cypripedium) have an optimal night temperature of 55°F.

A phytotron can tell us much about the optimal growing conditions of plants in general. In that way, we can start to understand why certain plants can grow together under the same conditions and form communities. It also can tell us which plants will do best in our garden. If, for instance, we are successful with cantaloupe, any other plant which has the same climatic requirements will do well in our garden, too. If instead we want to grow a plant with a very different light- or temperature-requirement, it is likely that such a plant will have to be pampered along. The real green-thumb plant grower grows plants suited to his particular environment. If anyone has a deep desire to grow a plant with a very different light- or temperature-requirement, he should indulge in a greenhouse which can provide an optimal climate suited to keep his plant healthy.

Thus far we have talked only about the optimal, or best, growing conditions for a plant. They may occur in a particular location, either regularly or exceptionally, but never continuously. Therefore we can never expect a plant to do as well in nature as in a phytotron, where all conditions can be maintained at their best for a plant at all times, unless of course the plant needs different conditions at different stages of its development. Even then we could try to follow such changes, by moving the plant from one condition to another. Most plants are attuned to the climate they normally live in. Thus a tulip or hyacinth follows the progress of the season by needing high temperatures for the initiation of leaves, which occurs during summer, intermediate temperatures for their flower initiation in autumn, and low temperatures to induce proper growth in the following spring.

It was generally known that a pear or peach bud does not open in spring unless the previous winter has been cold enough. Work in the Pasadena phytotron showed that a peach does not only need a cold winter immediately preceding the flowering season, but also a cold winter 1½ years before that, if it is to flower and fruit, the reason being that flower buds are not formed in the previous summer unless the winter before has been cold enough. Therefore, most peach varieties will never flower and fruit if grown in the tropics, where they are never subjected to cold.

All the above examples show how much we can learn about the behavior of plants, especially of garden flowers and agricultural crops, when they are investigated in a phytotron. Therefore, phytotrons will become increasingly important in our future evaluation of plants. It has been shown that we can even breed the proper plant for a specific climate, as has been done with tomatoes which can now be made to produce properly in the warm summer climate of Texas. ♠

The waterfall in the Climatron in the Missouri Botanic Garden in St. Louis, Missouri helps to provide the illusion of a tropical mountainside, and to cool and humidify the air.

THE CLIMATRON

Missouri Botanical Garden's Space Age Greenhouse*

ROBERT DINGWALL and BARBARA LAWTON

The Climatron, one of the world's most advanced display-research greenhouses, was opened to the public on October 1, 1960. It contains a large portion of the Missouri Botanical Garden's tropical and semi-tropical plant collections, in settings which closely approximate the native environments of various plants.

This unusual greenhouse was started in 1959, replacing three old houses which had reached an impossible state of age and decay. Dr. Frits W. Went, then Director of the Garden, developed the plans for the Climatron in consultation with St. Louis architects Murphy and Mackey. . . .

*Article and photos from Missouri Botanic Garden are printed with their permission.

The Climatron, a term coined [by Dr. Went] to emphasize the climate-control facilities of the structure, is 70 feet high and 175 feet in diameter. It contains a volume of 1,300,000 cubic feet and a ground surface of 23,000 square feet (over ½ acre). The dome shape is very economical for a building unsupported in the center; it has the smallest surface possible for its volume, and offers very interesting possibilities for enclosure and growing space. Triangular plexiglas (acrylic plastic) panels mounted with neoprene gaskets in an aluminum framework give a high degree of light transmission, allowing, even in winter, a fair amount of photo-synthesis.

The planning had to include air-conditioning to prevent excessively high temperatures

The Climatron in utilizing structural principles of the geodesic dome eliminates interior framework and makes possible greater utilization of space with a high degree of light transmission.

inside. Since the Climatron houses tropical plants it was sufficient to plan on air-conditioning by evaporation, which is the simplest and most economical way.

The size of the Climatron, larger than any greenhouse previously air-conditioned, posed several new problems. It was decided that, rather than trying to maintain an even temperature, a deliberate temperature gradient would be produced and maintained. During the day, air, cooled or heated to the desired temperature through water sprays, enters the greenhouse at the west end; exhaust fans are located around the eastern perimeter building. Necessary night heating is accomplished by an entirely separate air circulation system, producing a temperature gradient from south to north.

The structural and operational details of the Climatron are unique, and so is its planting pattern. Instead of growing specimen plants, areas have been planted to represent different ecosystems, such as an Amazonian jungle.

Continual pruning, planting, and removal of less desirable plants goes on, with the overall aim of allowing plants to assume their natural shape in a natural setting. Larger trees reach to the very top of the Climatron and the winding paths are so separated by luxuriant growth that a visitor really feels that he is in a jungle. Hundreds of thousands of school children have discovered and explored this strange land of the tropics without leaving the temperate zone of St. Louis.

The Climatron, ten years old in 1970, has taken its place as a breathtaking landmark of not just the St. Louis area but of the whole country. It has been featured in countless stories and publications throughout the world, is often glimpsed as the romantic setting of high fashion ads, and is a favorite spot for tourists and St. Louisans alike.

As to the special aesthetic appeal of the Climatron, the late Dr. Edgar Anderson expressed one aspect of it very well when he said, "It frequently has a special magic shortly before and after sunset. It is directly west of the Main Gate and the tropical lily pools, so that the sun sets behind it. Since the far side of the structure is twelve feet lower than the nearer side, the setting sun can shine into it from the rear, though concealed from the observer, filling the dome with sunset light and giving an opalescent glow to its surface. On the best of such evenings the sunset in the sky and the sunset in the Climatron go through a long series of changes which are variously mirrored in the pools."

The illuminated triodetic dome of Bloedel Conservatory atop Queen Elizabeth Park in Vancouver, B.C. houses tropical, arid and seasonal displays in a controlled atmosphere. Photo: Vancouver Park Department

THE BLOEDEL CONSERVATORY

*C. W. COUPAR**

"Dedicated to a better appreciation and understanding of the world of plants . . . " reads the inscription on a placque mounted at the entrance to the Bloedel Conservatory in Queen Elizabeth Park in Vancouver, British Columbia. That inscription aptly sums up the goal of the program made possible by the generous gift to the people of Vancouver and the Northwest by Virginia and Prentice Bloedel.

Under the management of the Board of Parks and Recreation, City of Vancouver, an effort is made to provide an interesting and colorful display for local citizens and out of town visitors. The Conservatory provides an indoor classroom for school children so that they can actually see such economic plants as the banana, pineapple and coffee tree. Actually over 300 varieties of tropical plant materials are on display from Africa, Mexico, Vietnam, Brazil, Java, Columbia, West Indies, China, Egypt, Fiji, Hawaii, Arizona, Florida and California.

The triodetic dome is a slight variation from the geodetic dome as in the Climatron, St. Louis. It is a semi-spherical structure 140 feet in diameter and 50 feet high, which covers 15,386 square feet of display area and encloses 423,000 cubic feet. The triodetic dome consists of 2,324 pieces of 5-inch diameter extruded aluminum tubing and 1,490 plexiglass bubbles set in aluminum glazing. The parking area, covered walkways and fountain plazas are on top of the Little Mountain reservoir, an important part of Vancouver's domestic water supply.

The Conservatory has a different heating and cooling system than that in the Climatron. It is heated and cooled by eight air handling

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*Mr. Coupar, member of the Board of Parks and Recreation, Vancouver, B.C., is Manager of the Bloedel Conservatory. Attention is called to *ARBORETUM BULLETIN,* Fall, 1970, Vol XXXIII, 3, pp. 10-11.

systems located around the perimeter of the Dome. Heat is generated by two 50 H.P. gas-fired hot water boilers and the cooling system is supplied by city water. All eight systems deliver air to a common concrete duct and the air is delivered to the dome through fifty-two equally spaced drum-type Punkah louvers at approximately 80,000 cu. ft. per minute. Outdoor air and return air enter each air-handling unit in mixing boxes and passes through dispensible media filters, hot water heating coils, city water cooling coils, centrifugal fans, and sound attenuators before being discharged to the perimeter supply duct. The system was designed to maintain 70°F inside the Dome at 0°F and 15 m.p.h. winds outside during winter, and a maximum of 80°F at 80°F outdoors in the summer.

Humidity control was designed so that there is always a dehumidifying load on the Conservatory. Humidification results from transpiration of plants and evaporation from soil and indoor water displays. For maximum summer design conditions, it was estimated that 25% of the solar heat gain would be released as latent heat of evaporation. Humidity is controlled by varying the ratio of outdoor air to return air and by operating the fog nozzles mounted under the air supply outlets in the tropical area.

A very informal display design provides a pleasing atmosphere to the visitors and has received many favorable comments to date. In essence, the design includes a tropical area with substantial permanent plantings as well as a series of pools (stocked with colorful Koi) and a large waterfall. Near the end of the tropical area a planter's hut is displayed surrounded by a large number of orchids, e.g., cattleyas, cymbidiums, cypripediums, oncidiums, etc.

One then enters the display area which features seasonal displays commencing first of all with the spring theme with azaleas, rhododendrons, spring bulbs and Easter lilies; followed by the summer displays with

A rope-suspended bamboo bridge permits close inspection of some of the 300 species of tropical plants in the Conservatory.

interesting foliage and texture predominating, then the fall display featuring chrysanthemums and to round out the year, a highly colorful Christmas display with colorful poinsettias in red, pink, white and marble. This year's Nativity scene was very well received and a large variety of Christmas plants such as cyclamen, azaleas, and poinsettias provided a most pleasing display.

Next, one enters the arid area with a fine collection of cactus plants originally donated by Mrs. Marchanton who was recognized as having one of the finest cactus collections in the Northwest.

One of the most attractive and interesting features of the Conservatory is the large number of colorful tropical finches that are allowed their complete freedom which adds to the overall scene. The birds are a great favorite of the camera enthusiasts. The real favorites and most popular, however, especially with the children, are the two colorful and talkative Macaws, "Goldie" and "Charlie Boy."

Complementing the Conservatory are the landscaped plazas and lighted fountains. This area surrounding the Conservatory provides a spectacular 360° panoramic view of the City and mountains. The view is particularly beautiful in the evening with the lighted fountains in operation. Since the Conservatory opened December 6, 1969, over one and a half million people have enjoyed visiting it and its surroundings.

Prominently displayed on the plaza is a magnificent sculpture by Henry Moore, titled "Knife-Edge, Two Piece." This sculpture was cast in bronze only three times before the mold was destroyed. The remaining castings are on display in the grounds of the House of Lords, London, England and on the Rockefeller estate in New York. Mr. Prentice Bloedel decided on this major work of art to complement the Conservatory because of the artist's world-renowned talent and rapport with nature.

Intensive development of Queen Elizabeth Park began twenty years ago when a joint Canadian Pulp and Paper Association/Board of Park Commissioners group met to discuss the possibility of an arboretum. Future plans for the park include additional landscaping, a restaurant complex, a floral hall and a hall of forestry. The Bloedel Conservatory provides an opportunity for the approximately half a million people visiting it each year to familiarize themselves with plant material from tropical and arid areas of the world.

Botany, the study of plants, occupies a peculiar position in the history of human knowledge. For many thousands of years it was the one field of awareness about which man had anything more than the vaguest of insights. . . . Plants are the basis of the food pyramid for all living things, even other plants. They have always been enormously important to the welfare of peoples, not only for food, but also for clothing, weapons, tools, dyes, medicines, shelter and a great many other purposes. . . . When Neolithic man, living in the Middle East about 10,000 years ago, discovered certain grasses that could be harvested, and their seeds planted for richer yields the next season, the first great step in a new association of plants and men was taken. . . . By the beginning of the 18th Century, botany as a science concerned itself primarily with cataloguing and naming plants. . . . The ability merely to identify plants is no longer the sole aim of modern botany. Today it takes in dozens of other sciences, ranging all the way from biochemistry to geography. It touches human history, sociology and economics in scores of places. It gives us insights into the origins of life and the processes of evolution. It is an intensely interesting subject. . . .

Frits W. Went, The Plants, pp. 9-10. Life Nature Library, Time-Life Books, 1963. Revised edition, 1971.

SOMETHING OF EVERYTHING IN EVERYTHING

*MARY McDIARMID**

My husband says that I'm a follower of Anaxagoras, the Greek philosopher who said "There is something of everything in everything." My sunroom seems to fit that description, having some of a great many things interspersed throughout: earth, clay, metal (objects) and water; fish, fowl, and beasts (human and dogs). Even fire is suggested by the light of the sun and the lamps and moving air, completing that ancient formula.

Into that all-inclusive world I escape each morning when my family leaves the house for classes or work. There I feed the fish and change their water; there I water my many plants with that well-aged and dechlorinated fish water, or do a bit of potting and pruning or grooming. I nip off old spent flowers from the tiny plants under the fluorescent lights; work with my cuttings growing for future bonsai studies; or practice my alto recorder on the chaise lounge; or work on a sculpture portrait, if a patron is sitting that day.

It all began after the narrow greenhouse on the south side of our sunroom had decayed beyond repair. A greenhouse builder came to give us an estimate to rebuild it. He suggested that we remove the french doors on that side and incorporate the sunroom with the greenhouse—at a price! After he left, my husband decided to leave the doors as they were and to make the sunroom itself into a semi-greenhouse. He bought brackets to fit over some of the french doors which comprise three sides of the room. On these he put movable shelves. I attached wires just below the ceiling, and wound them with long vines

*Mrs. J. B. McDiarmid, sculptor and member of Unit 84, an Indoor Plant Study Group, shares her enjoyment of plants with us. We hope others will share some of their specialties too.

originally from our 1949 University of Washington Union Bay Village house.

As shelves went up, more and more, and even more, plants seemed to appear. As my children tired of assorted fish and various birds, they donated them to the room. The fish bowls on the radiator added to the humidity, the canaries' songs to the garden atmosphere. My sculpture patrons were distracted and perhaps amused by "EVERYTHING!" The added fluorescent lights helped me with my art work, and flowers grew as well as leaves.

All things happened in that room: a dog ran through, children home from school did some sculpting under orchids, there was tea for all. Even a salamander hid in the asparagus fern. But NO horned toads!

Today there's a corner for plant and garden books, Arboretum booklets and quarterlies, music; a shelf for the pet's food and plant food; and containers for bonsai tools clippers, sculpture tools and my stand. On dark winter days I have a sunlit garden and a place to "escape" right here at home. I AM a follower of Anaxagoras!

But seriously, it's not difficult to bring a bit of nature indoors to brighten our dark Seattle winters. A "balanced atmosphere" such as developed in a climatron or greenhouse can be simulated to some degree. Light, temperature, humidity, and even ventilation, can be partially controlled in our homes.

If one chooses a dark corner for one's garden, fluorescent lights can brighten it inexpensively and make plants bloom during the winter. The latest 'word' from light garden specialists is to use an inexpensive 48-inch fixture with a 'warm white' and a 'cool white' tube together. This combination comes close to the sun's spectrum. Many new types of light tubes are being developed.

Beneath these tubes at various distances from the lights one can easily grow familiar and exotic blooming plants. From four to eight inches from the tubes gesneriads thrive: African violets, charming miniature sinningias, and nematanthus. Tiny orchids, miniature crown of thorns, lantanas,succulents or seedlings of plants and vegetables are also at home at this distance. Between twelve and eighteen inches from the lights larger orchids, geraniums, unusual-leaved begonias, indoor bonsai, and fruiting tomatoes luxuriate. And from eighteen to thirty-six inches from the lights large shade plants such as spathiphyllum, giant strap-leaved bromeliads, cane-type begonias, hibiscus and ferns flourish. Those old standbys—dracaenas, sansevierias, dieffenbachias, philodendrons and palms will grow around the lighted area to help hold in the moist atmosphere.

Most of these plants need humidity as well as light to grow. Trays with pebbles or bark chunks on the bottom, or a raised framework of strong wire mesh with the plants on top and water beneath can be used. Aerated fish bowls with waterplants give moisture and add variety. For an inexpensive beginning, aluminum turkey pans hold many plants and don't look bad as hanging branches and leaves camouflage them.

Without fluorescent lights, plants can be grouped close together on shelves or stands at a bright south (in winter) or east or west window. With added moisture a microclimate can be developed.

As for temperature, one can suit the plants to the area chosen. A chill bright sunroom or enclosed porch can grow many beautiful plants. Marvelous strap-leaved cymbidium orchids will flower, also cape primroses, geraniums, lantanas, epiphyllums and other cacti. Semi-hardy ferns and herbs will thrive with little care. Various citrus species need a cool spell before being returned to a warm area to flower and fruit.

If a garden is to be in a corner of a warm living room or den, 'warm' orchids, phalaenopsis and miltonias, as well as african violets, begonias and bromeliads will grow. And don't forget those avocado pits! A deep tray with pebbles and water placed on bricks or on 2×4's to prevent mildew and dripping will add humidity. Large ficus, philodendron or other reliable plants can be grouped around to create a controlled climate. There are as many possibilities as there are places and people to experiment.

What will YOUR microclimate be?

Jones and Jones is a fifteen member, multi-disciplinary firm with experience in landscape architecture, environmental planning, urban design and architecture. Virtually all of their work has been for the public, involving the firm in a wide range of community and agency participation at city, county, state and Federal levels, with twenty-five major projects completed in the four years since the founding of the firm.

Located in the Pioneer Square Historic District near Pioneer Square and Occidental Park (both designed by the firm), Jones and Jones is perhaps best known for its large-scale landscape analysis and recreation planning of major watershed basins and shorelines in the Northwest and Alaska. Such projects have ranged from the Nooksack River Plan in Whatcom County (for which they received the 1974 American Society of Landscape Architects Honor Award in Regional Development) to the recently completed Susitna River Study for the U.S. Army Corps of Engineers in Alaska, as well as the Sand Point Park Master Plan for the city of Seattle.

The broad range of individual skills and experience represented by the members of the firm who have initiated work on the East Campus Research Arboretum is representative of the rest of the office.

Grant R. Jones, Principal, is a 1962 graduate of the University of Washington and has been a guest lecturer in the Landscape Architecture and Forestry Departments since 1971 in site planning, open space/recreation planning and quantification of environmental resources. He was awarded the Sheldon Fellowship in Environmental Planning from Harvard University and spent considerable time researching the reclamation of polder lands in Holland. Prior to award of the fellowship he served as Consulting Landspace Architect to the Harvard Forest in Petersham, Massachusetts and was a Research Associate to the Department of Landscape Architecture Research Office at Harvard. Mr. Jones is a member of the Arboretum Foundation, and as past chairman of the Washington Chapter of ASLA has been a strong supporter of the research functions of the Arboretum.

Brian A. Gray is a graduate architect and landscape architect. Since joining the firm in 1972, he has participated in a number of environmental resource planning projects, building upon his graduate work at the University of Pennsylvania. Mr. Gray has also contributed significantly to the refinement and adaptation of a method for quantifying aesthetic values which he has successfully employed for the firm in numerous environmental impact assessments.

Peter M. Harvard is a graduate of the University's Landscape Architecture Department and is currently pursuing a graduate degree in Forest Management while serving as a Graduate Teaching Assistant in the department. Mr. Harvard is a member of the Arboretum Foundation and was a student participant in the initial studies dealing with the Arboretum shore-edge and landfill conditions conducted by the Landscape Architecture Department.

THE EAST CAMPUS RESEARCH ARBORETUM: PLANNING IN PROGRESS*

Jones and Jones, Landscape Architects and Environmental Planners.
(See page 12)

INTRODUCTION

Most long-time Seattle residents are familiar with the area known affectionately as the "Montlake Dump," but perhaps only a few are fully aware of the complexity of the challenge to convert this landfill site for use as a research arboretum. Other arboreta have overcome the problems of difficult landfill sites—notably the South Coast Botanical Garden in Palos Verdes, California, and the Botanical Garden of the Chicago Horticultural Society—but the Montlake landfill site appears to be highly unique in terms of the types of questions and unknown site variables for which answers must be found, and in the very real advantages and research opportunities offered at this location on the north shore of Union Bay. Mr. J. A. Witt addressed some of these problems and opportunities in the last issue of the *Bulletin* (Winter, 1975) and described the tentative plan developed for the East Campus Research Arboretum; this article will report on the recent planning progress of the research arboretum by the firm of Jones and Jones.

Part of the preliminary planning and assessment work undertaken for the East Campus Research Arboretum, in addition to an extensive literature review and site reconnaissance, has been an attempt to document the history of the filling operations at the Montlake site. Aerial photographs from the University Archives have been carefully examined, and these provide the spatial basis for our present understanding of the fill chronology and general configuration of fill material placed. Unfortunately, no careful records were kept of the type, volume or density of the landfill materials; this lack of initial fill information is one of the fundamental problems in planning land uses for the site. The accompanying sketches by Ken Caldwell, a staff member of Jones and Jones, illustrate some of the major events in the history of the site.

HISTORY OF THE SITE

Prior to 1916, most of the east campus was covered by the waters of Union Bay. By the early 1900's the Union Bay site was occupied by the deepest peat deposit in the State of Washington. At that time the shoreline edge of Union Bay lay directly adjacent to Husky Stadium, covering most of the site of the present Intramural Activities building and closely paralleling Montlake Boulevard on the west. To the north the shoreline extended across N.E. 45th Street into the present site of University Village, roughly paralleling Union Bay Place, N.E. 41st and Surber Drive.

With completion of the Hiram M. Chittenden Locks at Ballard in 1916, the surface of Lake Washington was lowered eleven feet

(continued on p. 18)

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*This article is drawn from *A Preliminary Report Documenting the Reconnaissance, Data Collection and Master Plan Study Design,* prepared by Grant R. Jones, Principal, Brian A. Gray, and Peter M. Harvard of the firm.

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A MANY SPLENDORED SPRING

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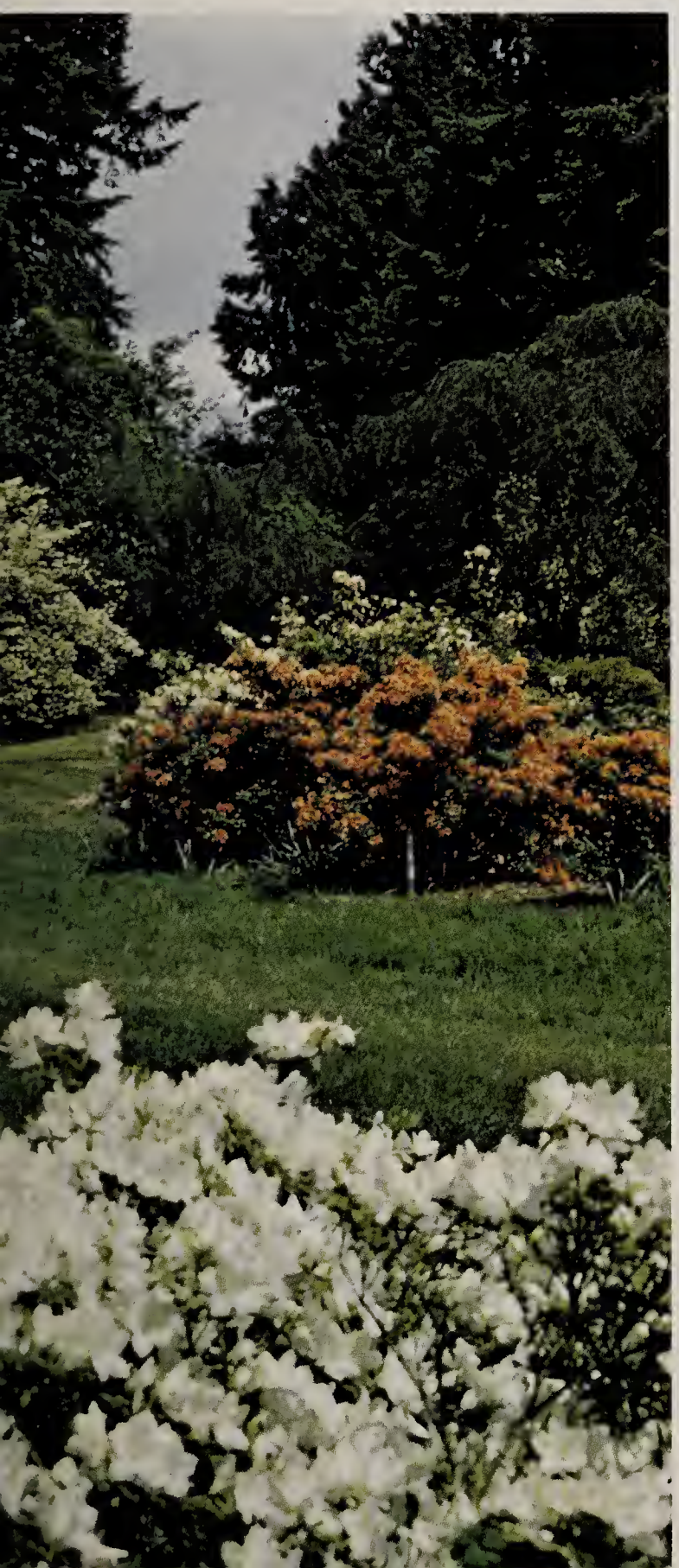
1. *Prunus sieboldii*
2. *Malus* 'Vanguard'
3. *Halesia monticola*
4. Azalea Way, May, 1974
5. *Camellia x williamsii* 'Stryker's Caty'
6. *Trillium ovatum*
7. Rhododendron 'Chief Joseph' *R. scyphocalyx* hybrid #1 x [*R. chrysanthum* x ('Rubina' x 'Fabia')]

Photos: Arboretum collection



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University of Washington Arboretum Classes

The College of Forest Resources coordinates the educational activities of the Arboretum. To register for classes, registration blanks are provided in SPECTRUM. If you wish your name to be placed on the list to receive SPECTRUM, phone 543-2590 or write University of Washington (DW-20), 400 Lewis Hall, Seattle, Wa. 98195.

The next series of University arranged classes will begin Fall Quarter, 1975. The Summer issue of the BULLETIN appearing the latter part of August will list classes that have been arranged for that period.

Membership Announcement

The Arboretum Foundation takes great pleasure in announcing that a valuable bonus will be given with any new $10.00 or larger membership or with the increase of any previous membership. THE LONG ROAD TRAVELLED is our special gift to these members. Written by Henry Schmitz and published by the Arboretum Foundation, it is a fascinating account of the early days of the University of Washington College of Forest Resources. Each member and friend of the Arboretum should read Chapter 7 on the formation and growth of the Arboretum. Members who already own a copy know that anyone interested in Seattle's early history or in forestry would welcome this volume as a gift.

The Foundation also wishes to commend Unit 1, the Juanita Graham unit, for its thoughtful gift of copies of THE LONG ROAD TRAVELLED to the library of each of the Seattle high schools. It also thanks Unit 29 for their gifts to branch libraries. The Foundation recommends that other units consider similar gifts to their high schools and libraries.

ELIZABETH MOSES

This is your Arboretum, kept alive by your support

We are pleased to welcome the following new members (January 1, 1975 through March 31, 1975):

Contributing — Mrs. D. W. Cook, Mrs. Joseph Fiore, Mrs. G. N. Holter. *Sustaining* — Mr. & Mrs. W. D. Fluharty, Mrs. Ward V. Williams, Ms. Elise Wright. *Annual* — Mrs. R. S. Beyer, Mrs. Christian J. Birkeland, Mrs. D. J. Bosse, Mrs. Murray Bothwell, Mrs. Peter F. Bowen, Steve Brightman, Mrs. E. E. Brighton, Miss Marian Brischle, Marjorie Burr, Mrs. Daniel Cahill, Mrs. Robert R. Cahill, Alice Ann Calvert, Mrs. Mickey Cannon, Mrs. Peter Carragher, Mrs. Arthur S. W. Chantry, John Cornelliussen, Mrs. Michael Crick, Nina De Rek, Mrs. Adam Doll, Mrs. J. A. Duncan, Sarah Dunn, Mrs. William L. Ean, Mrs. Gerald Eastwood, Mrs. C. R. Evans, Mrs. Gene S. Fadden, Mrs. Royal T. Ferry, Leigh Freeze, Mrs. Leigh Freeze, Mrs. William Gleim, Mrs. Milton Gordon, Ada Gowler, Mary Grapp, Maxine Hagen, Mrs. A. Basil Harris, Courtney Hashimoto, Mrs. Linda Helsell, Mrs. Robert N. Heyn, Mrs. William E. Hoke, Jackie Hutcheon, Mrs. Prescott Jordan, Mrs. Harold Kunkle, Mrs. Richard J. Lafferty, Mrs. Henry C. Mahnkey, Mrs. Robert J. Mahony, Miss Margaret McDiarmid, Mrs. James McCormack, Paul R. McDonald, Shiela McLarty, Mrs. Michael E. Meemen, Judith Millikan, Walter L. Mitchell, Mrs. Jack Newman, Mrs. Lyman J. Nielson, Mrs. Diann Oak, Mrs. Buchy N. Parsons, Philip Peoples, Pauline Peterson, Mrs. William R. Plunkett, Stella Porubov, Mrs. W. M. Read, John H. Robertson, Marnie Rodman, Mrs. Frank A. Ruffo, Jr., Mrs. Shane Sanderson, Mr. & Mrs. Don Seaton, Mrs. James W. Sinclair, Mrs. Stanley G. Stapp, Marjorie Sterling, Mrs. Robert Welch, Jennifer Wengler, Mrs. C. Thomas Yarington, Jr.

We are also grateful to the following who have increased their dues to: *Contributing* — Mrs. Carl P. Mann. *Sustaining* — William O. Griswold, Mrs. R. B. Long.

Arboretum Spotlight

Prunus x *hillieri* (Hillier's Cherry)

A major function of the Arboretum is the introduction and testing of new woody plants that perhaps have the potential of being useful ornamentals for northwest gardens. There are numerous such examples growing throughout the grounds ranging from dwarf ground-covers to large trees, and among the most spectacular are the flowering cherries. It is true that many of these handsome trees were not original Arboretum introductions, having been grown in the area for many years. However, there are several hybrids that were developed in recent years relatively speaking, which were first introduced by the Arboretum. Three come to mind: *Prunus* 'Hally Jolivette' from the Arnold Arboretum, Boston in 1948, *P.* x *incame* 'Okame' from the Morris Arboretum, Philadelphia in 1950, and *P.* x *hillieri* from Hillier's Nursery imported in 1948.

The latter cherry is a hybrid between *Prunus sargentii*, Sargent cherry, and *Prunus incisa*, Fuji cherry, that was raised in the Hillier Nursery, Winchester, England in the early 1930's. Both parents are Japanese natives. Sargent cherry is a large tree with shell-pink flowers; Fuji cherry is much smaller, often shrubby and has smallish white flowers. The child is intermediate between the two, becoming a moderate-sized tree perhaps thirty-five to forty feet tall at maturity with soft pink flowers reaching a peak of bloom in mid to late April. It is well thought of in England where it was given the Royal Horticulture Society's Award of Merit in 1959.

The Arboretum has several plants of this hybrid; the original is placed on the east side of Azalea Way near Loderi Valley, where it is now about thirty feet tall and as much across; it has been flowering well since 1953. About mid April the plant is a cloud of very soft pink blossoms, each about an inch across composed of five notched petals that are slightly darker in the bud than when open.

There is another form of *P.* x *hillieri* in England, an upright cultivar called 'Spire' which Mr. Harold Hillier says is "probably the best small street tree raised this century"—a broad statement but coming from one of the world's foremost tree authorities it must carry some weight. We have been unable to import plants of 'Spire' because of quarantine restrictions on all *Prunus*, but if it is as good as the form we grow it must be a superior plant indeed.

Prunus x *hillieri* not only is attractive in the spring but has the added bonus of developing fall color similar to *P. sargentii*, orange red.

It is too bad that this fine hybrid cherry is not more readily available from commercial sources since it is a really good ornamental.

JOSEPH A. WITT

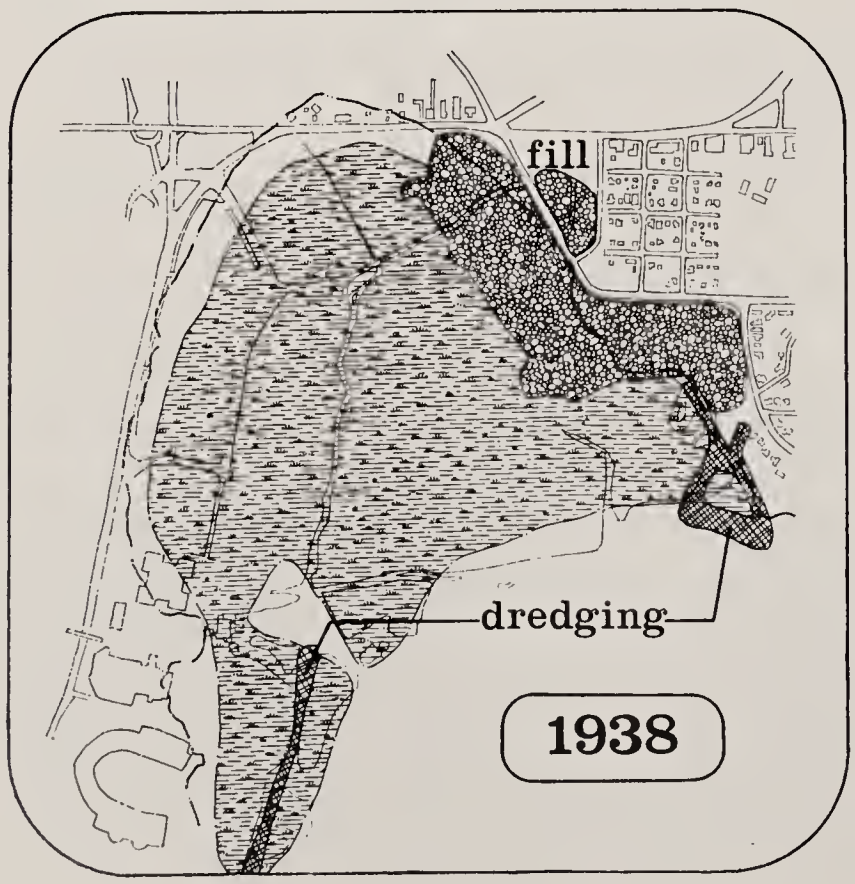
FOUNDATION ANNUAL MEETING

This year the Foundation will hold its annual dinner meeting on May 29 instead of the usual June date. Jones and Jones, Landscape Architects selected by the University to prepare a master plan and environmental statement for the development of the East Campus Research Arboretum will be the guest speakers. They will give a new slide presentation and briefly review the work to date, stressing the opportunities that the site offers. Members of the firm will be present to answer questions and discuss the project. Joseph Witt, Curator of Plant Collections, will assist. Save the date on your calendar.

(continued from p. 13)
(at high water), and the northern inlet of Union Bay emerged as a vast cattail marsh bounded loosely by the former shoreline.

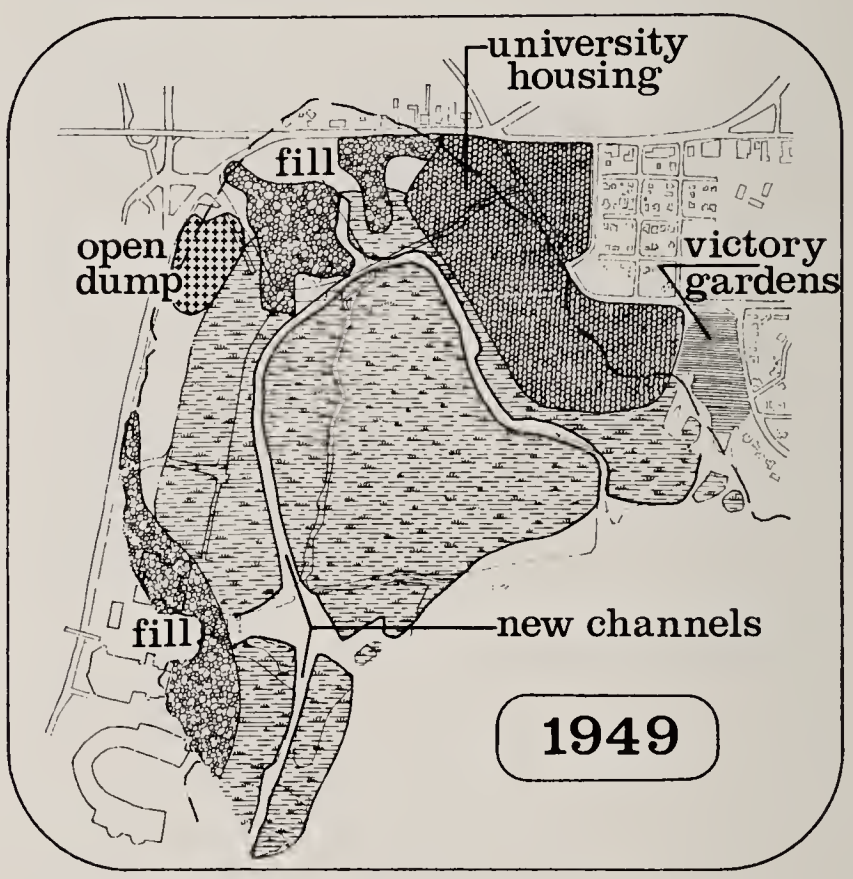
In 1926 the City of Seattle began its rubbish and fill operations at the northeast corner of the former inlet; starting from "Five Corners" (the intersection of N.E. 45th and Union Bay Place) the original fill site extended south to the location of the present "Fire Arts" buildings.

The 1938 illustration shows the Five Corners fill site at its greatest active extent. Substantial new dredging in the east marsh increased its amount of open water surface, while to the southwest the dredging of the old "Crew House Point" channel carved away the first large island of the present-day island chain so familiar to recreation boaters.



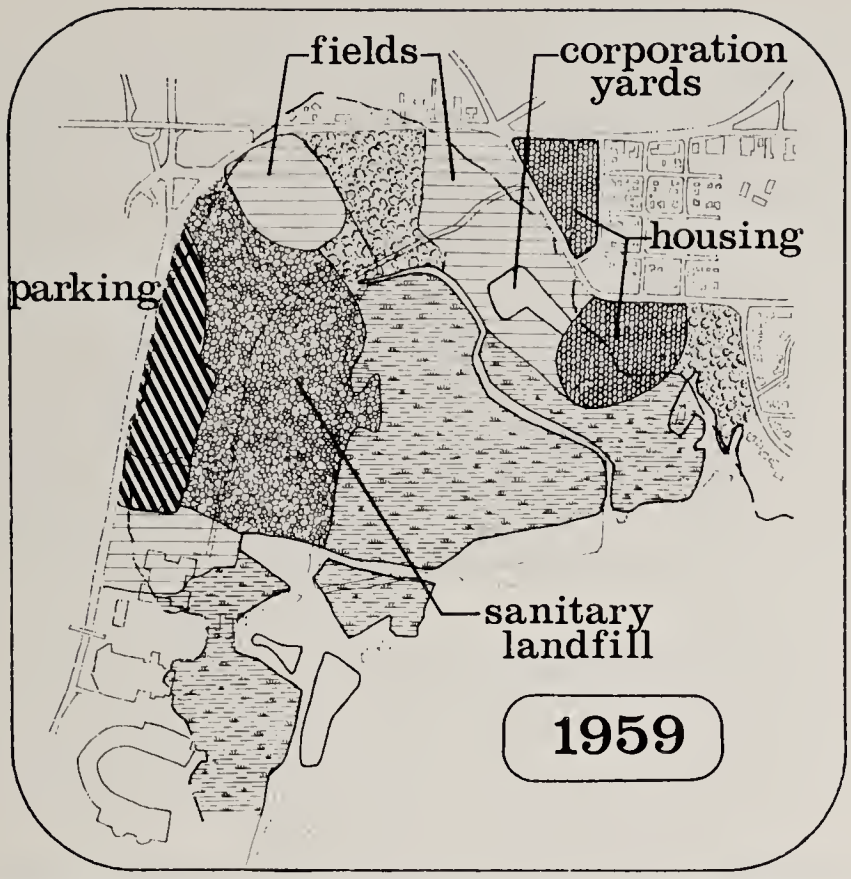
University housing was built in "The triangle" in 1946, and the original Five Corners fill site was regraded in preparation for the construction of additional housing. The open dump site near the present north pedestrian bridge expanded and rubbish filling covered large portions of the present driving range.

The 1949 illustration shows a sudden increase of filling to the southwest along Montlake Boulevard. At this time a 60-inch storm drain from Laurelhurst was introduced into the east marsh. The major apparent change in 1949 was the dredging of a continuous perimeter-loop channel through the interior of the marsh.



In 1954, increasing public pressure halted the practice of open burning. In 1956 "modern" sanitary landfill methods were instated, which required nightly covering of the day's fill with a layer of earth. This change in landfill policy and practices, coupled with an expanding amount of refuse from Seattle's growing population, quickly increased the rate of marsh reclamation by landfill. By late 1956 the western portion of the interior perimeter-loop channel had been covered over by refuse and the first Montlake parking lot was completed.

The rate of filling accelerated even more from the late fifties until 1972. The 1959 illustration shows a major portion of the housing removed from the Five Corners area, and recreation fields graded and sodded on former fill areas. A new technique for filling



was instituted during this time at the advice of University Professor Walter Dunn. To keep the peat from squeezing out from under the landfill edge and into the bay, dikes of timber and rubble were placed to form large "cells" or compartments to contain the fill and stabilize the underlying edges of peat.

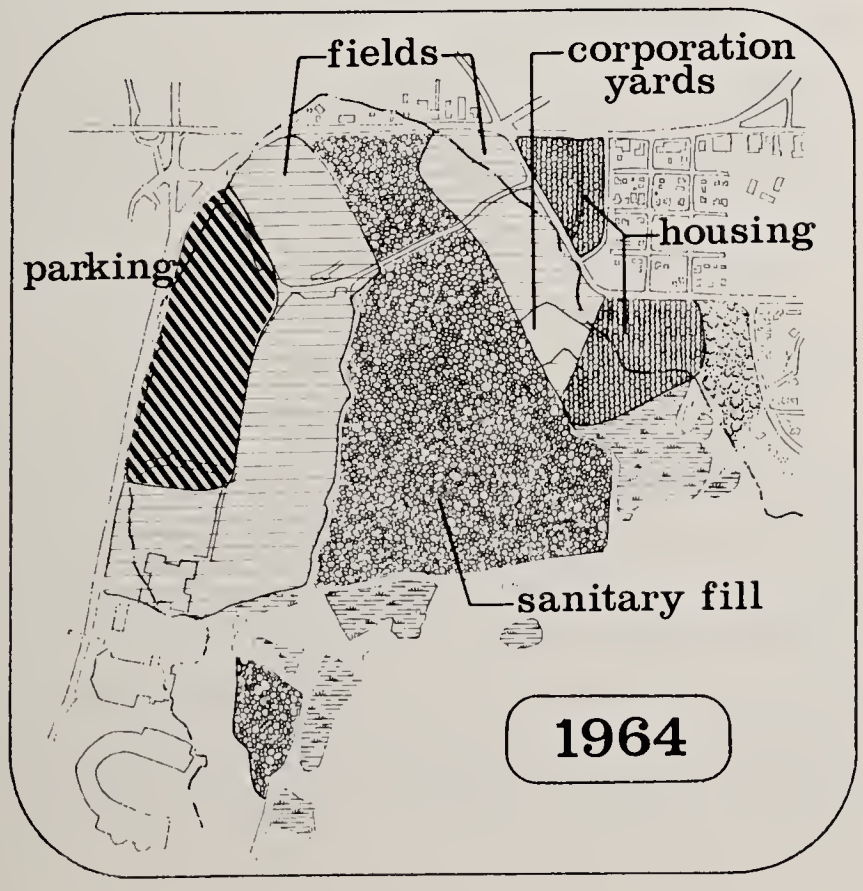
This diking method allowed rapid expansion of the fill area. Fields and parking lots continued to utilize the outer edges of the previously completed fill. The diking and filling activities actually extended beyond the shoreline and entered Union Bay at this time, and the increased weighting of the peat by diking and filling forced up several small new peat islands in Union Bay.

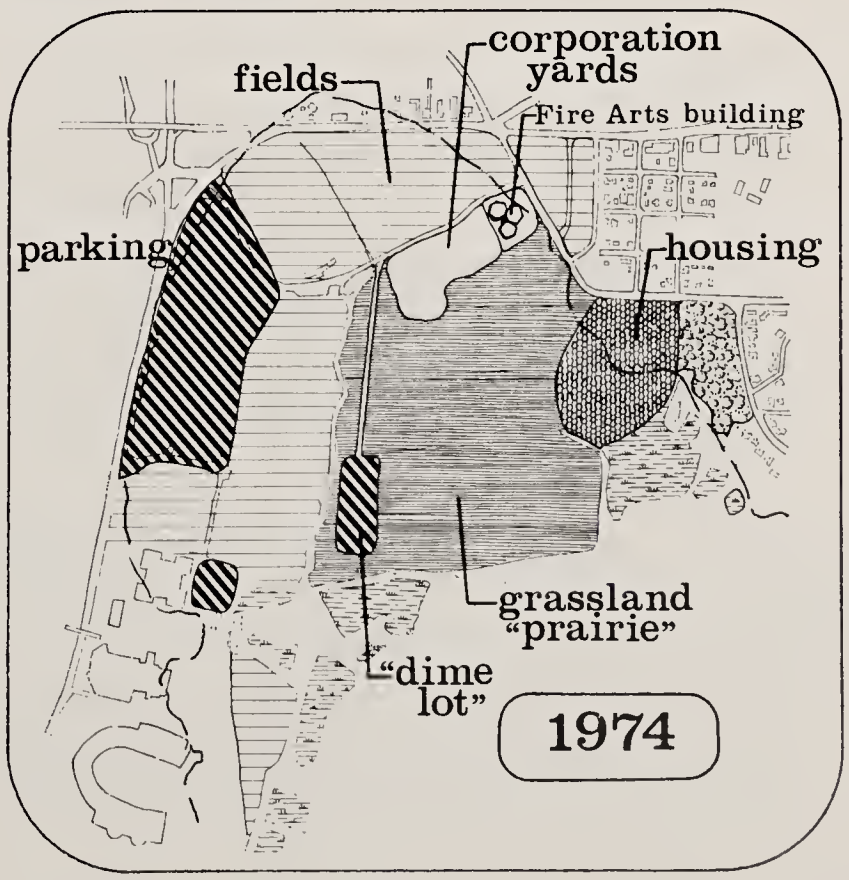
The remaining (eastern) segment of the interior perimeter-loop channel system was filled over in 1964 as the landfill extended toward its most eastern limit, pushing further outward into Union Bay as it moved. The new (present) west canal was constructed by carving a channel through dirt fill which was placed on top of a continuous timber mat dike.

Garbage filling was discontinued in 1965, and that portion of housing previously built in the triangle was removed in 1969. Uneven ground settlement and a high water table forced the removal of Graves Field to higher ground near Five Corners, and the Fire Arts facility was completed in 1970.

In 1971 rubble and earth fill from the Health Sciences expansion was dumped and spread across the site, and final regrading and seeding was undertaken. The "dime lot" was constructed in the southwestern part of the fill, and the University began to move its corporation yards to land west of Fire Arts.

No substantial site changes have occurred from 1972 to the present time. Roads have been repaired, paths gravelled, and wet spots partially drained. The 1974 sketch shows the site essentially as it is today: surrounded by parking lots and playing fields, penetrated by housing, parking and equipment storage yards. The gently rolling surface supports a grassy prairie-like cover bordered by peat islands, cattails and occasional trees along the shoreline. All that remains of the extensive marshlands which once covered the area are the peat islands and the small marsh behind the shoreline of Union Bay at the eastern edge of the site.





CURRENT SITE ANALYSIS

Approximately one hundred and fifteen acres of this landfill area have been designated by the University as the potential site of the East Campus Research Arboretum. To determine the kinds of site studies and additional site information which will have to be known to successfully plan the research arboretum, we have outlined some potential constraints upon and opportunities for the siting of structures, utility systems and circulation patterns, earthwork and outplantings, research areas, and maintenance or enhancement of environmental quality.

Constraints Upon Development

The siting of buildings, utility systems and circulation patterns on portions of the site may be constrained by the following unique site conditions:

- High rates of differential ground settlement limit foundation stability and the usable life of underground utilities, roads and parking, create problems of adequate surface drainage, increase additional hazards on site from seismic disturbance, and may result ultimately in inundation as some portions of the site subside to the level of Union Bay.
- Actively decomposing landfill materials are overlain by a very shallow soil cover and permeated by a high water table, limiting the use of basements and ease of placement of foundations, underground utility systems, roads and paths.
- Gases produced by anaerobic decomposition within the fill and underlying peat layers include methane, hazardous because it is flammable and highly explosive if trapped in enclosed places and because it may migrate laterally underground to vent unpredictably in adjacent areas.

Reshaping the existing landforms and establishing suitable areas for plantings could possibly be constrained by:

- Unfavorable existing soil conditions, a thin highly-compacted soil layer of low fertility with occasional barren zones of surface cracking and ventilation of subsurface gases, and a high water table containing concentrations of leachate which may inhibit the root growth of certain plants.
- Limited opportunities to employ extensive earth mounding to provide positive surface drainage and adequate soil depth, due to the instability and potential settlement of portions of the landfill site.
- The somewhat limited existing range of microclimatic conditions across the site which may favor growth of certain plant species over others.

Opportunities for research are many but may be somewhat limited because of the site's:

- Peculiar geologic and soil conditions.
- High water table, leachate concentrations, and limited surface drainage.
- High exposure, atypical vegetation cover, variable topographic relief, adjacency to Union Bay and urban conditions of Seattle.

While the landfill site is presently fairly high in amenities as open space, its continuing decomposition produces methane gas (flammable and explosive), hydrogen sulfide (offensive in odor), and high concentrations of leachate which pose an ever-present threat to the water quality of its drainage canals and Union Bay. Its unique habitat conditions provide the site with extensive wildlife populations which deserve protection. An additional environmental constraint placed upon development of the site is the shore edge modification restrictions of the Shoreline Management Act.

Opportunities for Development

Although the above environmental constraints upon use of the site are quite formidable, there are many very favorable conditions for the development of the site as a research arboretum. In addition to the site's potential assets previously named by Mr. Witt (*Bulletin*, Winter 1975, p. 27)—prime views, rolling terrain, undeveloped marsh areas and shoreline,

proximity to and ownership by the University —there are very positive environmental opportunities offered by this unique site. Structures located on-site may be enhanced by the following conditions:

- Stable areas do exist on site which can accept structures.
- Provisions for additional interior canals, embayments and ponds may enhance the siting of structures and improve storm drainage.
- Utilization of on-site holding ponds in conjunction with interior canals may diminish surface water pollution from storm runoff and facilitate controlled surface drainage.
- The use of windbreaks, shelter belts, windmills, solar energy and adaptive architectural design and siting can minimize climatic stress on facility users.

Utility systems and circulation patterns could be enhanced by:

- Potential for collection and use of methane gas as an energy source.
- Opportunity to control pedestrian/vehicular circulation through use of surface water features.
- Possible use of windmills for irrigation and pumping of water through canals to reduce irrigation costs and improve the surface water quality.

Potential opportunities for reshaping the land surface and enhancing the conditions favorable for plant growth may include:

- Use of old dikes as foundations for earth berms and planting of deep-rooted species for windbreaks, display or research.
- The development of shoreline and wetland plant communities not presently available within the interior of the site along new canals and ponds.
- Use of berms, depressions, windbreaks and shelter belts to increase the microclimatic diversity as required for siting and establishing adaptive plant communities.

Research opportunities abound. Nearly all of the previously mentioned constraining conditions of the site are in themselves unique opportunities for productive research investigation. There are opportunities for:

- Almost unlimited research to monitor the behavior of a saturated landfill site over a peat bog and observe plant community succession, find adaptive species, and experiment with inherent stresses imposed on use of such sites.
- Study of water quality controls and minimization of leachate production through control of runoff, percolation, infiltration and transportation.
- Investigation of the potential use of leachate for special irrigation purposes, and the possible recycling of leachate through the landfill to promote fill stabilization and maintain a balanced water budget.
- Studies of plant community adaptations to climatic stress and long term monitoring of changes in macro/microclimate across the site.
- Investigation of practical utilization of solar energy, wind and adaptive climatic design in the Pacific Northwest.

Environmentally, there are opportunities for:

- Potential enhancement, utilization and environmental management of the unstable landfill site.
- Dimunition of offensive odors and explosion hazards imposed by gas production and lateral movement of gas.
- Enhancement of the site through the addition of surface water features.
- Improvement of aquatic and terrestrial habitats.
- Monitoring and controlling leachate production and seepage hazards.
- Increasing the habitability of the landfill site for plants, animals and man.

MASTER PLAN PHASING

The preliminary identification of the site's opportunities and constraints described above have allowed us to begin on-site field studies and to prepare our work program. The master planning and preparation of the En-

vironmental Assessment data for the East Campus Research Arboretum will be done concurrently to avoid the occurrence of any major information gaps between the planning of the facilities and functional operations of the arboretum and assessing their environmental impacts; this procedure will facilitate sensitive environmental planning. The planning and assessment process may generally be thought of as following eight major phases:

PHASE 1. *Undertake site inventory and analyze data*

The natural, cultural and aesthetic resources of the site will be further identified and the data analyzed and organized to facilitate planning decisions and to serve as background material for the environmental assessment.

PHASE 2. *Visit and analyze similar arboreta*

Members of the Jones and Jones staff will travel to several arboreta across the country to analyze their layout and operations. Tentative plans include visits to the South Coast Botanical Garden, the Botanical Garden of the Chicago Horticultural Society, the Morton Arboretum, the Cary Arboretum of the New York Botanical Society, and the National Arboretum.

PHASE 3. *Identify problems and opportunities/establish goals and policies*

Site information gathered during Phase 1 will be combined with the kinds of opportunity and constraint considerations outlined above to determine the site's hazards to development as well as those resources of the site which are vulnerable. Preliminary goals and objectives will be drafted and refined.

PHASE 4. *Establish functional criteria*

The specific functional criteria for development of each portion of the site as a research arboretum will be analyzed and evaluated.

PHASE 5. *Develop major concepts and alternatives*

From the baseline data, goals, objectives and functional criteria established in Phases 1 through 4, major concepts and alternatives will be developed for the East Campus Research Arboretum.

PHASE 6. *Evaluate and select alternatives*

Each of the major concepts and alternatives will be evaluated by assessing its relative environmental impact, its functional advantages and disadvantages and its economic and fiscal feasibility.

PHASE 7. *Draft master plan*

The selected alternative(s) will be refined and developed as the master plan for the East Campus Research Arboretum.

PHASE 8. *Organize environmental assessment data*

The final material for the environmental assessment of the East Campus Research Arboretum will be organized and presented.

SUMMARY

Interest in the project has been high, and support for the expansion of the Arboretum has been expressed by several groups. Development of this new facility offers the opportunity for research at all levels, ranging in scale from microscopic biotic investigations to monitoring longterm ecological changes. The East Campus Research Arboretum could serve as a regional field station to investigate behavioral responses of plants, animals and man to environmental stress in temperate regions. Not since the actualization of the Arboretum in Washington Park has such an opportunity offered itself to the citizens of the Northwest to improve its capacity for providing an arboretum facility befitting a major metropolitan center.

The challenges of the unique problems to be overcome and the prime opportunities to be realized in the development of the East Campus Research Arboretum are becoming clearer to us each day. We hope that all friends of the Arboretum will share in our enthusiasm for the prospect of that challenge.

SOME OF OUR FAVORITES
Won't You Send Us Yours?

Rhus typhina— Staghorn Sumac

*MRS. PAUL SAYRE**

The Staghorn Sumac is one of our favorite fall plants—glowing like a harvest moon, about October. We've found an unusual place for it, next to our sea wall on Horsehead Bay. It seems to thrive with the wind and salt breezes.

Rhus typhina is classed as a shrub or tree, never growing more than 30 feet tall. Its branches are velvety and reminiscent of a deer's horns with its winter outline. The birds love its shelter of feathery leaves. A kingfisher uses it as a high perch to catch his morning breakfast of fish.

The sumac grows in the driest of soils, requires no maintenance and after its unusual winter outline it will have leaves up to 5 inches long with 11 to 31 leaflets in the summer. About June, greenish flowers appear, followed by red fruit borne on a torch about 6 inches long.

While this attractive plant is non-toxic, it is interesting to note that poisin ivy and poison oak also belong to the Rhus family. Another member of the Rhus family is *R. verniciflua*, or the Lacquer tree which produces the famous Japanese lacquer. The name Rhus comes from the original old Greek term for the tree.

A group planting of sumac is a most delightful outdoor area for children's play. Each fall the neighbor children gather under its colorful branches and call it "Indian Village" where they pretend the overhanging branches are Indian teepees painted in gold and orange and green.

A rugged planting for next to the sea, or in a clump if one has a large area in the landscape, the Staghorn sumac is an attractive, interesting plant the year around.

*Mrs. Sayre, Gig Harbor, Washington responded to our earlier request by sending this description of one of her "Favorites." Won't you share yours with us too?

Book Reviews

DWARF SHRUBS, Donald Wyman. Macmillan Publishing Co., Inc., N.Y., 1974. Color photographs by Dr. Wyman. Drawings by Pamela Anne Bruns. 140 pp., 35 color illustrations. Price $7.95.

Donald Wyman brings to his latest book, *DWARF SHRUBS*, the observations carefully compiled during his years of experience as Horticulturist (and since 1970 Horticulturist Emeritus) at Arnold Arboretum, the breadth of knowledge gleaned from travel as well as from close association with other botanists and arborists and from participation in horticultural organizations, and the language skill resulting from writing countless articles on woody plants and a number of horticultural books.

The small size of the book gives no hint of the broad scope of the information it contains. A useful map of hardiness zones of the United States and Canada appears at the beginning and again at the end of the book. Short chapters treat such subjects as "Planting," "Fertilizing," "Winter Protection" and, the most informative one, "How Plants Are Dwarfed."

Then the reader will find most interesting and helpful for reference the lists of "Dwarf Plants . . . " which fulfill special requirements such as " . . . With Colored Foliage," " . . . of Interest in Flower" or " . . . of Interest in Fruit." The final list of greater length than the others covers ten special uses by means of checked columns.

The alphabetical catalog of some 300 plants is the meat of the work. Descriptions include common names (some of which seem to me to be contrived while other much used ones are omitted), size, hardiness zone, native locale, soil and exposure requirements, and general appearance of each shrub. Drawings by Pamela Anne Bruns are scattered generously throughout this section. The detail of conifers is less definitive than in the case of broadleaved plants but the purpose in many cases is to show the general appearance of the whole shrub. It follows naturally that when a portion of the plant is portrayed the representation is more exact.

I appreciate immensely the inclusion with these descriptions of bits of historical data such as the year of introduction, or of personal knowledge of some plantsman's work, or the reason for the name—either botanical or common—which has been applied.

Dr. Wyman's many excellent color photographs range widely in subject from a single plant through an extensive heather garden to the large rock gardens of Kew and Wisley. The color reproduction is unusually good.

Experience may make one skeptical of the subtitle Dr. Wyman has chosen, "Maintenance-Free Woody Plants for Today's Gardens" but we cannot quarrel with the timeliness of the subject, *DWARF SHRUBS*, which is admirably treated in a handbook desirable for the libraries of novice gardener and landscape architect alike. You will want to buy *DWARF SHRUBS* and keep it readily available for reference.

F. K. ROBERSON

TREES FOR YOUR GARDEN, Roy Lancaster; Editions Floraisse. Floraprint Ltd., Calverson, Nottingham, England., 1974. 147 pp., illustr.; price: ?

This is an attractive yet unpretentious book for those in a quandary as to which type of tree to plant in their yard, provided they are not interested in a conifer. Frankly, I find it a bit of deceptive packaging to present such a volume under the all-encompassing title *TREES*, to wrap it in a colorful cover showing among several trees a towering sequoia, and to leave it up to the customer to find out on page 16 that conifers will be dealt with in a later companion volume.

The bulk of the contents is devoted to a brief description of some 350-odd hardwood cultivars, many of them less well-known but often worth knowing and usually highlighted by a well chosen color photograph. This descriptive part is quite effectively presented, contains many useful comments on hardiness, soil and care requirements, planting, etc., and reflects much horticultural judgment by the author. Several sensible lists ordering trees, e.g., by habit, soil requirements, situation, leaf types, etc., are dispersed throughout the text, and they would be even more useful if they could be found via some non-random principle. In fact, if I had to confine myself to *one* criticism (which I won't), I would direct it at the publisher's violation of some of the most basic rules of book organization. It is bad enough that the British blessed us with ounces, acres, and gallons, but we just won't stand any longer for such nonsense as a listing of tree species by common but not by Latin names, and this on page 17 rather than at the beginning or the end; or the absence of a subject index; or the scanty listing on another random page of four references for further reading without any dates or publishers' names. There are other weak points that can hardly be ignored. For example, what is the use of reserving one page for the most superficial treatment of pests and diseases at a time when every gardener is seriously concerned about which chemical to use at which dose against which insect to minimize environmental damage? Similarly, why deal with pruning if there is a mere page available for it? I would also argue that it hardly helps elucidate the concept of "variety" if we draw the analogy to the different moods a person (" = species") may experience, as is done on the one page dealing with the naming of trees. A simplified picture of the world need not be a distorted one; as in a satellite photo it may lack detail, but it should show the major geographical features in the right proportions.

In sum, I see the value of this book in the colorful portrayal of selected hardwood cultivars provided we trust Mr. Lancaster that those he omitted are not worth considering. It is too limited in scope to be considered a useful manual for the home gardener, and on the other hand, it will hardly elbow its way into the esthetics market what with the current flood of eye catchers.

R. F. STETTLER
College of Forest Resources
University of Washington

WILD BERRIES OF THE PACIFIC NORTHWEST, by J. E. (Ted) Underhill. Superior Publishing Company, Seattle, Washington. 1974. 128 pages. Price $9.95.

Having been a confirmed wild berry enthusiast since childhood, I particularly enjoyed this small book whose author sees eye to eye with me on the value of red huckleberries and other under-appreciated native fruits. All the Northwest's wild berries—both the poisonous and the edible—are described in detail, each with a drawing and/or colored photograph, and an evaluation of its merits or dangers. The close-up photographs of individual species are clear and bright; the habitat shots, however, have suffered somewhat in reproduction. The book covers the area from Alaska to northern California and western Montana and Wyoming. It is good to see *Solanum dulcamara* listed with the common name Bittersweet instead of the erronious Deadly Nightshade beloved of our newspapers and television. One does wish that the many distinct and desirable species of *Vaccinium* (huckleberries) had received the more complete treatment accorded *Ribes* (currents and gooseberries) and *Rubus* (raspberries and blackberries). I'm no judge of the usefulness of the section on wine-making, though I was impressed by the author's praise of the superior bouquet of wild blackcap wines. But I can certainly vouch from personal experience that the jellies, jams, pies, shortcakes, etc., made from the recipes in the "table" section will be well worth the effort. With such a book available, the city-bred or out-of-area parent need no longer shun or teach his children to shun all wild berries just because he himself never learned which ones are safe.

JEAN G. WITT

AN ALBUM OF ALASKAN WILDFLOWERS, by Jeanne Laurence. A Salisbury Press book by Superior Publishing Company, Seattle, Washington, 1974. 100 full color reproductions. $45.00.

I was asked to criticize this beautiful book, and for the first time I have a reason to regret my training in Botany.

A very small percentage of the people looking at this book will be botanists, and so, very few of its readers will notice the mistakes. However, since they are there, I feel I must mention the most obvious.

This magnificent book, beautifully bound with a gold cover would be a wonderful addition to any wild flower lover's library. The drawings are accurately done in most cases, and the colors are good.

Using the black background and uniform size would suggest she planned to have them published, although the completion of the series took her twenty years. This was done after the death of her husband—the famed Sydney Laurence.

Her depiction of the Alaskan Wild Flowers is quite extensive. She obviously did a great deal of traveling to get the variety of flowers she portrays. Many we consider rare and choice garden plants, and they are found in a wide variety of habitats. Her travels to search them out must have been a thrill to her—and added a great deal to the book.

There are many minor errors (particularly in spelling, which only a taxonomist would notice), but there are a few that should be mentioned. The pages and plates are not numbered so that I will let the names of the plants identify the mistake: *Antennaria margaritacum*—a synonym of a pearly everlasting, and she pictures a daisy-type flower. Her drawing labeled *Vaccinium oxycoccos* pictures a quite different species. There are two different drawings of *Loiseleuria procumbens*, one right and one wrong. The Moss "flowers" are a mystery.

MAREEN S. KRUCKEBERG
Rare and Native Plants Nursery Operator

NEW ZEALAND ALPINE PLANTS, by Alan F. Mark & Nancy M. Adams. A. H. & A. W. Reed, Wellington, New Zealand. 1973. Soft cover—$13.50; Hard cover—slightly higher.

No artist, plant lover, or alpinist will be able to resist this exciting Flora!

The author describes the origin and structure of the mountains (the main ranges are less than two million years old) and the Alpine zone in general (area maps are inside front and back covers). The highest mountain in the South Island is Mt. Cook, 3764 m. (12,349 ft.); in the North Island Mt. Raupahu is highest at 2518 m. (8,260 ft.). It recently awoke and spewed great clouds of ash over a large area of the countryside.

The Alpine environment is next described, then the general features of the Alpine flora (93% of the species are endemic to New Zealand and the Subantarctic Islands!). Seven fascinating black and white and one color illustration enhance the chapter on the communities of vegetation.

The ferns, conifers, and flowering plants are then described. All are pictured in water colors beautiful enough to frame for a living room wall. The plant families are arranged systematically and ecological aspects are emphasized in the descriptions. Geographical and altitudinal distributions are also given. Keys and technical terms are kept to a minimum, but there is a glossary for those necessary.

My best wishes and fervent hopes are with these two dedicated and talented persons—hopes for the success of the purpose of their book: " . . . to improve the knowledge of and increase the general interest in the many splendid natural features (of) these areas . . . " Conserving Alpine vegetation "as close to its natural state as possible will provide the best safeguard for conservation of alpine soils and maximum control and yield of water, potentially the most usable product of the mountains." I feel the plants are worth conserving too. I saw them last winter and they were a slight too thrilling to forget.

MARJORIE W. BAIRD

SUPPORT
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ALASKA-YUKON WILD FLOWERS GUIDE, by Helen A. White and Maxcine Williams. Alaska Northwest Publishing Company. Price $7.95

This book is very suitable for the tourist-botanist in Alaska. It describes 164 species with full-color photographs, line drawings and a written description. The text usually notes flower size, range, habitat, relative rarity of the species, and now and then anecodotal comments regarding the plants, and use by native Alaskans, etc. Edible and poisonous species are noted. There is a list of those species that may be successfully raised from seed in the home garden. This is coupled with comments on the conservation of rare species and collecting techniques of the more common. The book also contains a short glossary for those background botanical terms that make identification more positive. Three indexes make cross-referencing convenient. Although this book does not cover all species found in Alaska, most of the more striking flowers are described beautifully. The book itself is easy to carry being paper-backed and a convenient 5½ × 8½ inches in size.

JOHN PUTNAM

GERDA BENGTSSON'S BOOK OF DANISH STITCHERY, Gerda Bengtsson. Van Nostrand Reinhold Company, New York 1972. 135 pages. Price $10.95.

This delightful book, liberally illustrated in both black and white and color, should intrigue gardeners and plant lovers who are also crafts-minded, particularly those whose hobby is embroidery. The author, a designer in the embroidery workshop of the Danish Handcraft Guild since 1940, details step by step the methods she has developed for translating the wild plant materials of Denmark into designs for Danish embroidery. The resulting patterns are worked in tiny cross-stitch with cotton thread on coarse linen. The commonest weeds, such as plantain, nettle, dandilion, and mustard become charming motifs for wall hangings, pillow covers, place mats and so forth. Starting with live plants or pressed ones, the steps progress from colored drawings, through squared paper, to the actual working of the colors on the cloth; and the results are dainty, botanically accurate, carefully shaded designs of unusual charm and beauty.

Methods of designing for types of embroidery other than cross-stitch are also described. The illustrations include such things as wild carrot and water hemlock worked in French knots, stem stitch, and various lacy cross-stitches; pussy willows in French knots with appliqued leaves; the entire rosette of a bedstraw plant in satin stitch and stem stitch. Several pages are devoted to stitchery techniques; suitable linen types are illustrated; and there is a chart of thread colors. Actual designs by the author may be ordered through the Danish Handcraft Guild, whose address is given in the back of the book, along with a U. S. source for the Danish Flower Thread.

We tried out some of the stitchery techniques and color shading, using patterns drawn from a few of our Northwest wild flowers, and were quite pleased with the results. (DMC and Clark's embroidery thread, available locally in a wide range of colors, is entirely suitable.) We think this book will prove a very satisfactory guide for anyone who would like to have a try at designing her own native floral motifs.

JEAN G. WITT

CLIMBING AND SCREENING PLANTS, by Noel J. Prockter. Faber & Faber, London.

You may never have had a window through which you viewed a neighbor's cluttered backyard, or an ugly wall to hide, or a work-area to screen, but if you ever have any of these, or other screening problems, you will really appreciate this book's solutions. The author deftly deals with them in the chapters on selecting the right plant for the spot and their care and maintenance.

Mr. Prockter is not only experienced in cultivation of trees and shrubs but was until recently Assistant Editor of "Amateur Gardening" and is now Gardening Correspondent of "The Sun." His book on propagation has gone into five editions.

The chapter on Pests and Diseases was written by experts, Miss Joyce Maynard and Miss Audrey V. Brooks. The chapter covering the laws relating to trees and shrubs unfortunately applies to Great Britain, not the United States.

Not only are there many very excellent black and white photographs, but the three selective lists at the back of the book are extremely helpful. The first lists plants according to their uses, i.e., "wall and fence plants," "Seaside screen trees," "Climbing plants for tubs or pots," etc.; the second list describes the plants themselves and the third is in chart form and one can see at a glance the plant's virtues, uses, and soil requirements.

This is a book which should be in the library of every landscape architect and nurseryman, and would indeed be an asset to every horticulturist and gardener.

MARJORIE W. BAIRD

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COMING EVENTS CALENDAR

DATE	EVENT
May	
1 & 2	UNIT COUNCIL PLANT SALE
5	Rhododendron Study Group
7	House Plant Study Group — Day
8	Unit Council Board Meeting
8	Foundation Executive Committee Meeting
13	House Plant Study Group — Night
15	Unit Council Meeting — Mr. Ed Schriner on "Human Trampling in the Wilderness"
19	Northwest Natives Study Group
22	Unit Council Program Planning Meeting
28	Arboretum Explorers
29	**Annual Membership Dinner Meeting**
June	
2	Rhododendron Study Group
4	Bulletin Editorial Board Meeting
4	House Plant Study Group — Day
5	Unit Council Board Meeting
10	House Plant Study Group — Night
16	Northwest Natives Study Group
25	Arboretum Explorers

LOOKING AHEAD

July	
2	Bulletin Editorial Board Meeting
21	Northwest Natives Study Group
23	Arboretum Explorers
August	
6	Bulletin Editorial Board Meeting
18	Northwest Natives Study Group
27	Arboretum Explorers

REMEMBER

Every TUESDAY — Greenhouse Day; Every FRIDAY — Herbarium Committee; Every FOURTH WEDNESDAY — Arboretum Explorers

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